

# IMPACT OF STRUCTURAL AND TECHNOLOGICAL CHANGES ON SELECTED ASPECTS OF THE STEEL INDUSTRY OF POLAND

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The global steel market continues to show an upward trend, but the growth rate is much lower than in previous years. Despite the constantly growing demand for steel, the situation of the Polish steel industry is becoming increasingly difficult. The Polish economy, due to a number of investment projects in the construction, the railway, the power engineering, and the machinery industry, needs more and more steel products. A number of factors have influenced the changes that have occurred in the steel industry. They ranged from cost increases in almost all areas of market activity, through regulatory conditions, to structural and ownership changes. The article presents how the restructuring process that has taken place in recent decades has influenced the structural and technological changes in the steel industry and the current situation of this sector of industry.

**Key words:** steel industry, restructuring, energy efficiency, management, Poland

## INTRODUCTION

The European Coal and Steel Community, established in 1952, is commonly considered to be the beginning of modern European integration. Nowadays, this term has a completely different meaning than back then. In December 2019, the European Union (EU), which is a continuation of that community, reached an agreement on climate neutrality in 2050. In practice, this means, among other things, a reduction of greenhouse gas those industries that are very energy-intensive, such as the steel industry.

Bearing in mind that the steel industry is of strategic importance to the economy of the EU, it would be expected that measures would be taken to protect it in some way from the effects of the changes caused by the rather rapid process of moving away from fossil fuels. The effects of the lack of such regulations are already visible today. According to the presidents of the largest European steel companies (ArcelorMittal Europe, Celsa, Outokumpu, Salzgitter, and Tata Steel Europe), a sudden and clear change has already taken place in the prospects of the European steel industry. Across the EU green energy investments. The de facto carbonization policy that has been adopted will therefore have an impact on the European economy as a whole, particularly emissions to 55 % by 2030 and a review of legislation on phase-out of carbon and on some steel mills have been announced for closure, while in others production is being reduced, with thousands of jobs being at risk as a result (in 22 EU countries, the steel industry directly employs around 330 000 workers and provides around 2,5 million jobs in related industries) [1].

Growing difficulties in the industry in question have also been noticed in Poland. On the initiative of the Polish Steel Association, a draft resolution on measures to improve the competitiveness of the national steel industry was created, which was subsequently adopted in October 2019 by the Social Dialogue Council. This resolution includes, amongst other things, the following demands for the Polish government [2]:

- Take actions aimed to adapt the EU's trade defense tools, in particular to address the shortcomings of the EU's protective measures in the form of tariff quotas for steel products.
- Support the implementation in EU law of the so-called carbon compensatory measure.
- Introduce significant discounts for the steel industry with regard to power market charges.
- Introduce reduced rates for transmission and distribution of electricity for energy-intensive consumers.
- Intensify measures aimed to reduce wholesale electricity prices.

These demands in a way take into account the unique characteristics of the Polish economy but do not relate directly to the steel industry. In the last thirty years, Polish steelworks have undergone a technological and organizational transformation and are able to function provided that equal competitive conditions in the market are ensured.

## STRUCTURAL AND TECHNOLOGICAL CHANGES

In the 1990s, the process of restructuring of the steel industry began in Poland. During the first phase, it resulted from the transformation connected with the adaptation to the rules of the free market economy and during the second phase, it concentrated on adapting to the

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rules of the European Union. During this period, this sector of the economy was affected by quite radical changes. They mainly involved such processes as adjustment of the production structure to the demand structure, implementation of new technological solutions, reduction of energy and material consumption, and increase in labor productivity.

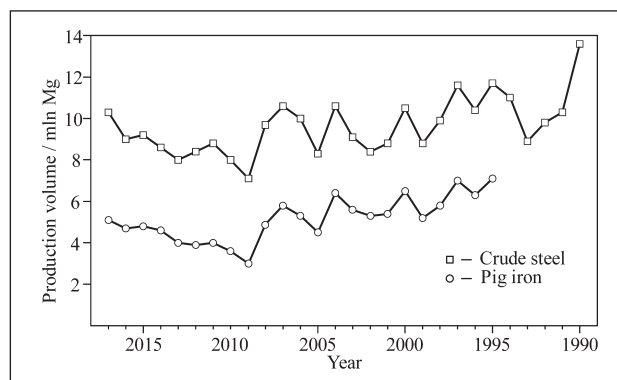
As a result of the changes implemented, among others, as a part of the “Program for Restructuring of the Iron and Steel Industry in Poland” in the years 1999-2017, out of the original number of 26 steelworks, only nine steel manufacturers remained in Poland [3]:

ALCHEMIA S.A., Huta Batory, ArcelorMital Poland S.A., Branch in Dąbrowa Górnicza; ArcelorMital Poland S.A., Branch in Cracow; ArcelorMital Warszawa Sp. z o.o., CELSA Huta Ostrowiec S.A., Cognor S.A., Ferrostal Łabędy Branch in Gliwice, Cognar HSJ in Stalowa Wola, CMC Poland Sp. z o.o. (Zawiercie Steelworks), ISD Huta Częstochowa Sp. z o.o.

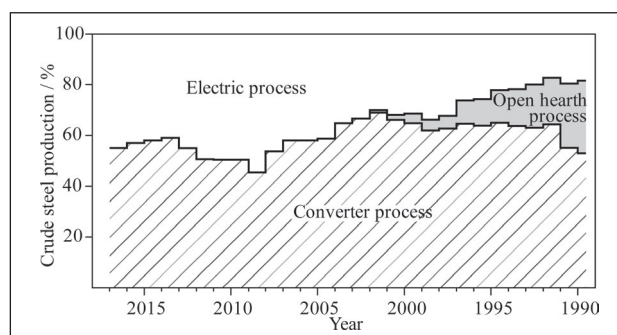
Currently, i.e. at the end of 2019, this number has been further reduced because, in June 2019, the court declared the company ISD Huta Częstochowa to be in liquidation. Although the trustee signed an agreement with Sunningwell International Polska to lease (with preemptive right) the assets of the steelworks for one year, the future of this facility remains uncertain [4].

The production of crude steel and pig iron also decreased during this period (Fig. 1). In 2009, for example, the volume of crude steel produced decreased by almost 50 % compared to 1990. It has now stabilized at around 75 % compared to the same base year. The existing differences in the production volume of crude steel and pig iron were due, on the one hand, to the declining number of steel mills in operation and, on the other hand, to the general economic situation. The first factor had a limited impact as the major steel producers not only remained in the domestic market but also significantly upgraded their process lines, bringing the industry to European level.

Metallurgy in Poland has been completely privatized and production of steel in open hearth furnaces has been stopped (Fig. 2). The open-hearth process ended in 2002 (in 1990 – 28,7 %, in 2002 – 1 %). When analyzing the structure of crude steel production, it is important to point out the clear advantage of the converter process, which accounted for as much as 69 % of total production in 2002 and was the lowest in 2009 – 45,4 %, while the share of continuous steel casting increased from 7 % - 82 %. The share of the converter process in the structure of steel production increased to about 55 % - 60 %. Hot-rolled products are listed among the main products of the steel industry, in addition to pig iron and crude steel. These products represent between 71 % (in 2004) and almost 93 % (in 2013) of the volume of crude steel production. In the period under consideration, the largest volume of hot-rolled finished products was produced in 2018 and was equal to 8,9 million tons. Hot-rolled products are divided into long products and flat products. Throughout the entire period under consideration, long products prevailed (from 60,5 % in



**Figure 1** Production of crude steel and pig iron in Poland in 1990-2018 [3]

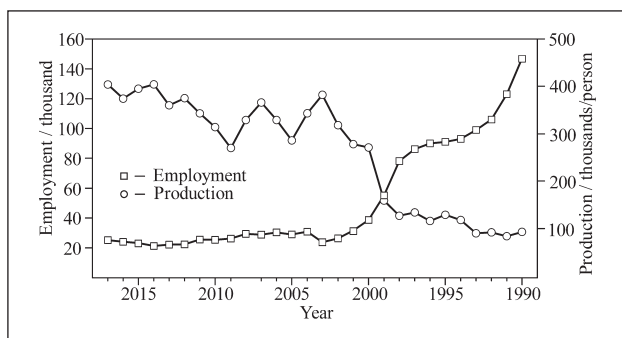


**Figure 2** Crude steel production by process in 1990-2018 [3]

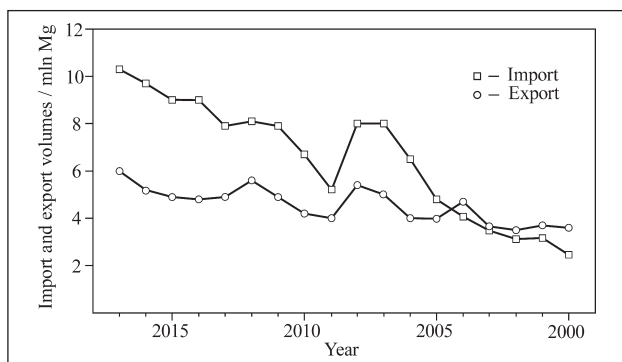
2013 to 65,9 % in 2003 and 2010). The long hot-rolled product group is dominated by bar production (47 % in 2018). The hot-rolled flat products group is dominated by the production of strip plates (88 % in 2018) [3].

In the post-war history of Poland, metallurgy was a very important and strongly developed branch of the socialist economy. Clearly, such a radical restructuring process had to bring about far-reaching changes. They were most significant in the sphere of employment. The significant decrease in the number of employees in the analyzed industry (Fig. 3) was caused by many complementary factors. In addition to forced reductions, voluntary resignations, and transfers associated with workers obtaining the right to pre-retirement and retirement benefits; outsourcing of a part of the business has played a major role. A reduction of the often over-expanded organizational structure made it possible to separate a number of companies (e.g. repair, forwarding, trade, etc.) which could function on their own in the market and still perform some of the tasks supporting their former parent company.

The data shown in Figure 3 shows that employment was reduced from 147 thousand in 1990 and has recently stabilized at about 25 thousand, which means that it decreased by almost 83 %. A different situation can be observed in the production volume per employee. The change from 84 Mg of steel in 1991 to 413 Mg in 2018 means an increase by 392 %. It was possible to achieve such a level of productivity not only thanks to restructuring of the labor force but is also an outcome of all modernization activities in the technical and technological aspect. This process continues as the goal is to reach EU standards, i.e. productivity rate of about 500 Mg of



**Figure 3** Employment in the steel industry and per capita production in 1990-2018 [3, 6]



**Figure 4** Exports and imports of finished steel products in 2000 - 2018 [3]

products sold per employee (e.g. at ThyssenKrupp, productivity reaches 680 MG [5]).

It should also be noted that the consumption of steel products in Poland has been steadily increasing for many years (2018 – 14,8 million Mg, 2017 – 13,6 million Mg, 2016 – 13,1 million Mg, 2015 – 12,5 million Mg, 2014 – 12,3 million Mg) while their imports are also increasing. Until 2004, exports exceeded imports (the largest in the period under consideration was in 2000 – 1,14 million Mg). Since 2004, the international balance of trade for steel products has been constantly negative (e.g. in 2016 – 4,5 million Mg, 2018 r. – 5,9 million Mg). One of the main reasons for this unfavorable balance of trade is the influx of cheap steel from outside the EU.

## CONCLUSION

At the turn of the twenty-first century, the Polish economy underwent transformation related to adaptation to the principles of free market economy and the rules of the European Union. The Polish steel industry was one of the areas that were affected by quite radical changes. The restructuring process in this industry, which continued for several years, resulted in the fact that out of twenty-seven steel producers in 1990, only nine remained in 2018. Accordingly, with the decrease in the number of steel mills, employment also decreased from 147 thousand to 25,5 thousand (i.e. by 83 %) in the period in question. The privatization of the main steel producers and the resulting inflow of foreign capital (e.g. ArcelorMital, CELSA, and CMC) also contributed to the acquisition of new technologies. All these factors resulted in an increase in the production volume per employee by 392 %.

Currently, the Polish metallurgy is in another difficult period. The increase in energy prices and fees for CO<sub>2</sub> emissions and the change in the situation in the global steel market (due to the introduction of a 25 % duty on steel imported to the United States) contributed to the decrease of steel production in Poland in the first half of 2019 by 8 % [7]. Despite an increase in global steel production, a similar phenomenon has also occurred in other countries of the European Union and this is mainly due to the climate policy adopted by the EU member states.

The European steel industry is, and will in the near future be, dependent, among other things, on the price of CO<sub>2</sub> emission quotas (as has already been underlined in the paper [8]). Therefore, there are more frequent references to “green steel” and the introduction of new technologies to reduce carbon dioxide emissions. In metallurgy, attempts to replace coal with hydrogen have continued to be made for a long time. But only now have they become economically justified. A pilot steel mill is already being built in Lulea, where the process is to be carried out without the use of fossil fuels. According to the Swedes, if the hydrogen technology proved its worth in this installation, its use in the remaining Swedish steel mills would mean a reduction in CO<sub>2</sub> emissions by about 10 % [9].

However, the change of the technology and the significant reduction of CO<sub>2</sub> emissions alone will not solve the current problems. The transition in metallurgy (also in other industries) to climate- and environmentally friendly technologies will result in a sharp increase in demand for electricity [10] and it is the “nature” of the latter that will determine the final environmental effect. From this perspective, the situation of the Polish metallurgy seems to be difficult, as currently the main fuel in Polish power plants is coal (about 80 %).

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**Note:** The professional translator for English language is Lingua Lab s.c. Weronika Szyszkiewicz, Małgorzata Dembińska, Kraków, Poland